CLAIMS

1. A rare-earth Y-zeolite-containing catalyst for cracking hydrocarbons, characterized in that the rare-earth content in crystal lattice of the rare-earth Y-zeolite, calculated in RE_2O_3, is from 4 to 15% by weight, the original unit cell size is from 2.440nm to 2.465nm and the equilibrium unit cell size after 100% steam-aging treatment at 800℃ for 17 hours is larger than 2.435nm.

2. A catalyst according to claim 1, characterized in that the rare-earth content in crystal lattice of the rare-earth Y-zeolite, calculated in RE_2O_3, is from 6 to 12% by weight.

3. A catalyst according to claim 1, characterized in that the original unit cell size of the rare-earth Y-zeolite is from 2.445nm to 2.460nm and the equilibrium unit cell size is larger than 2.440nm.

4. A catalyst according to claim 3, characterized in that the original unit cell size of the rare-earth Y-zeolite is from 2.450nm to 2.458nm and the equilibrium unit cell size is larger than 2.445nm.

5. A catalyst according to one of claims 1~4, characterized in that the Na_2O content of the rare-earth Y-zeolite is less than 1.0% by weight.

6. A catalyst according to claim 5, characterized in that the Na_2O content of the rare-earth Y-zeolite is less than 0.5% by weight.

7. A catalyst according to one of claims 1~4, characterized in that the Si/Al ratio of the rare-earth Y-zeolite is from 6 to 20.

8. A catalyst according to claim 7, characterized in that the Si/Al ratio of the rare-earth Y-zeolite is from 8 to 15.

9. A catalyst according to one of claims 1~4, characterized in that the differential thermal collapse temperature of the rare-earth Y-zeolite is higher than 1000℃.

10. A catalyst according to claim 9, characterized in that the differential thermal collapse temperature is from 1000 to 1056℃.

11. A catalyst according to claim 1, characterized in that the content of the rare-earth Y-zeolite is from 10 to 50% by weight.

12. A catalyst according to claim 11, characterized in that the content of the rare-earth Y-zeolite is from 15 to 40% by weight.

13. A catalyst according to claim 12, characterized in that the content of the rare-earth Y-zeolite is from 15 to 35% by weight.

14. A catalyst according to claim 1, characterized in that said catalyst contains zeolite with MFI structure, whose weight ratio to the rare-earth Y-zeolite is from 0.01 to 0.5.

15. A method for preparing the catalyst for cracking hydrocarbons according to claim 1 , characterized in that the method has following steps:

(1) drying the rare-earth Y-zeolite till its water content less than 10% by weight, then in a weight ratio of $SiCl_4$: Y-zeolite= 0.1~0.9: 1, the zeolite reacts with $SiCl_4$ gas carried by dry air at 150~600℃ for 10min to 6 hours and is purged by dry air for 5min to 2 hours after reaction, and then the residual soluble by-products in the zeolite are washed out by decationized water; and

(2) 10~50% by weight of the rare-earth Y-zeolite obtained in step (1), 10~60% by weight of a binder and 2~75% by weight of a clay are mixed and pulped, and formed by spray drying.

16. A method according to claim 15, characterized in that the rare-earth Y-zeolite disclosed in step (1) is selected from the industrial product of REHY and REY zeolite, or the product of the rare-earth ion exchanged NaY zeolite with or without drying.

17. A method according to claim 16, characterized in that the rare-earth content of the industrial REHY zeolite, calculated in RE_2O_3, is from 6 to 16% by weight and the Na_2O content is more than 4% by weight.

18. A method according to claim 16, characterized in that the rare-earth content of the industrial REY zeolite, calculated in RE_2O_3, is from 10 to 20% by weight and the Na_2O content is more than 2% by weight.

19. A method according to claim 16, characterized in that the rare-earth ion exchange process of NaY zeolite is carried out by exchanging the NaY zeolite with Si/Al ratio higher than 3.5 and the aqueous solution of rare-earth chloride in a weight ratio of NaY: $RECl_3$: H_2O=1: 0.1~0.25: 5~10 at 80~90℃ for 30 to 60min under a pH more than 3.5.

20. A method according to claim 15, characterized in that the water content of the rare-

earth Y-zeolite disclosed in step (1) after drying is less than 5% by weight.

21. A method according to claim 15, characterized in that the reaction temperature disclosed in step (1) is from 200 to 500℃.

22. A method according to claim 15, characterized in that the content of the rare-earth Y-zeolite is from 15 to 40% by weight.

23. A method according to claim 15, characterized in that the content of the binder is from 15 to 40% by weight.

24. A method according to claim 15, characterized in the that content of the clay is from 20 to 60% by weight.

25. A method according to claim 15 or claim 23, characterized in that the binder is selected from one or more of pseudoboehmite, alumina sol, silica sol and phosphorus-alumina sol.

26. A method according to claim 23, characterized in that the binder is a double-alumina binder of pseudoboehmite and alumina sol in a weight ratio of 10~40: 0~30.

27. A method according to claim 26, characterized in that the weight ratio of pseudoboehmite and alumina sol is 15~25: 2~25.

28. A method according to claim 26 or claim 27, characterized in that the weight ratio of acid and alimina in the acid treatment of pseudoboehmite is 0.1~0.6 when using double-alumina binder.

29. A method according to claim 28, characterized in the that weight ratio of acid and alimina is 0.15~0.35.

30. A method according to claim 15 or claim 24, characterized in that the clay is the clay usually used in cracking catalyst matrix.

31. A method according to claim 30, characterized in that the clay is selected from Kaolin, halloysite, montmorillonite, bentonite or sepiolite.

32. A use of the catalyst according to claim 1 in processing residuum.

33. A use according to claim 32, characterized in that the residuum is selected from full atmospheric residuum, distilled oil blended with atmospheric residuum or distilled oil blended with vacuumed residuum.

Amended Claims

1. A rare-earth Y-zeolite-containing catalyst for cracking hydrocarbons, characterized in that the rare-earth content in crystal lattice of the rare-earth Y-zeolite, calculated in RE_2O_3, is from 4 to 15% by weight, the original unit cell size is from 2.450nm to 2.458nm and the equilibrium unit cell size after 100% steam-aging treatment at 800℃ for 17 hours is larger than 2.430nm.

2. A catalyst according to claim 1, characterized in that the rare-earth content in crystal lattice of the rare-earth Y-zeolite, calculated in RE_2O_3, is from 6 to 12% by weight.

3. A catalyst according to claim 1, characterized in that the equilibrium unit cell size is larger than 2.440nm.

4. A catalyst according to claim 3, characterized in that the equilibrium unit cell size is larger than 2.445nm.

5. A catalyst according to one of claims 1~4, characterized in that the Na_2O content of the rare-earth Y-zeolite is less than 1.0% by weight.

6. A catalyst according to claim 5, characterized in that the Na_2O content of the rare-earth Y-zeolite is less than 0.5% by weight.

7. A catalyst according to one of claims 1~4, characterized in that the Si/Al ratio of the rare-earth Y-zeolite is from 6 to 20.

8 A catalyst according to claim 7, characterized in that the Si/Al ratio of the rare-earth Y-zeolite is from 8 to 15.

9. A catalyst according to one of claims 1~4, characterized in that the differential thermal collapse temperature of the rare-earth Y-zeolite is higher than 1000℃.

10. A catalyst according to claim 9, characterized in that the differential thermal collapse temperature is from 1000 to 1056℃.

11. A catalyst according to claim 1, characterized in that the content of the rare-earth Y-zeolite is from 10 to 50% by weight.

12. A catalyst according to claim 11, characterized in that the content of the rare-earth Y-zeolite is from 15 to 40% by weight.

13. A catalyst according to claim 12, characterized in that the content of the rare-earth Y-zeolite is from 15 to 35% by weight.

14. A catalyst according to claim 1, characterized in that said catalyst contains zeolite with MFI structure, whose weight ratio to the rare-earth Y-zeolite is from 0.01 to 0.5.

15. A method for preparing the catalyst for cracking hydrocarbons according to claim 1, characterized in that the method has following steps:

(1) drying the rare-earth Y-zeolite till its water content less than 10% by weight, then in a weight ratio of $SiCl_4$: Y-zeolite= 0.1~0.9: 1, the zeolite reacts with $SiCl_4$ gas carried by dry air at 150~600℃ for 10min to 6 hours and is purged by dry air for 5min to 2 hours after reaction, and then the residual soluble by-products in the zeolite are washed out by decationized water; and

(2) 10~50% by weight of the rare-earth Y-zeolite obtained in step (1), 10~60% by weight of a binder and 2~75% by weight of ~~a~~ clay are mixed and pulped, and formed by spray drying.

16. A method according to claim 15, characterized in that the rare-earth Y-zeolite disclosed in step (1) is selected from the industrial product of REHY and REY zeolite, or the product of the rare-earth ion exchanged NaY zeolite with or without drying.

17. A method according to claim 16, characterized in that the rare-earth content of the industrial REHY zeolite, calculated in RE_2O_3, is from 6 to 16% by weight and the Na_2O content is more than 4% by weight.

18. A method according to claim 16, characterized in that the rare-earth content of the industrial REY zeolite, calculated in RE_2O_3, is from 10 to 20% by weight and the Na_2O content is more than 2% by weight.

19. A method according to claim 16, characterized in that the rare-earth ion exchange process of NaY zeolite is carried out by exchanging the NaY zeolite with Si/Al ratio higher than 3.5 and the aqueous solution of rare-earth chloride in a weight ratio of NaY: $RECl_3$: H_2O=1: 0.1~0.25: 5~10 at 80~90℃ for 30 to 60min under a pH more than 3.5.

20. A method according to claim 15, characterized in that the water content of the rare-earth Y-zeolite disclosed in step (1) after drying is less than 5% by weight.

21. A method according to claim 15, characterized in that the reaction temperature

disclosed in step (1) is from 200 to 500℃.

22. A method according to claim 15, characterized in that the content of the rare-earth Y-zeolite is from 15 to 40% by weight.

23. A method according to claim 15, characterized in that the content of the binder is from 15 to 40% by weight.

24. A method according to claim 15, characterized in the that content of the clay is from 20 to 60% by weight.

25. A method according to claim 15 or claim 23, characterized in that the binder is selected from one or more of pseudoboehmite, alumina sol, silica sol and phosphorus-alumina sol.

26. A method according to claim 23, characterized in that the binder is a double-alumina binder of pseudoboehmite and alumina sol in a weight ratio of 10~40: 0~30.

27. A method according to claim 26, characterized in that the weight ratio of pseudoboehmite and alumina sol is 15~25: 2~25.

28. A method according to claim 26 or claim 27, characterized in that the weight ratio of acid and alimina in the acid treatment of pseudoboehmite is 0.1~0.6 when using double-alumina binder.

29. A method according to claim 28, characterized in the that weight ratio of acid and alimina is 0.15~0.35.

30. A method according to claim 15 or claim 24, characterized in that the clay is the clay usually used in cracking catalyst matrix.

31. A method according to claim 30, characterized in that the clay is selected from Kaolin, halloysite, montmorillonite, bentonite or sepiolite.

32. A use of the catalyst according to claim 1 in processing residuum.

33. A use according to claim 32, characterized in that the residuum is selected from full atmospheric residuum, distilled oil blended with atmospheric residuum or distilled oil blended with vacuumed residuum.